California Integrated Waste Management Board (CIWMB)
Life Cycle Assessment (LCA) of Organics Diversion Alternatives and Economic Analysis of Greenhouse Gas (GHG) Reduction Options

APPROACH TO RECYCLING COST ANALYSIS

December 17, 2008

This memorandum expands on the Technical Approach provided by the project team on July 31 by providing additional details on the project team's approach to the recycling cost analysis. The following sections cover:

- Calculation of net operating and capital costs for recycling
- Calculation of recycling cost savings
- Definition of the categories of recyclable materials to be modeled
- Definition of the categories of collection systems and processing facilities to be modeled
- Description of the data gathering methodology that will support the recycling cost analysis

Calculation of Recycling Net Operating Cost and Capital Cost

As with the organics management alternatives covered in the study, the net operating cost of recycling activities is defined as:

Net Cost = Collection Cost + Transportation Cost + Processing Costs – End-Use Material Value

All operating costs and revenues will be analyzed on a per-ton basis, based on assumptions identified in the Technical Memo. Operating cost categories generally include the key annual cost drivers such as labor, utilities, depreciation, fuel, and general administration. Capital costs categories include initial capital costs as well as annual estimates for equipment, replacements, upgrades, and expansions. While the survey requests data on these and other specific cost categories, the survey responses may not consistently track to these categories depending on the completeness of the survey responses. We plan on following up with survey respondents as necessary to clarify cost data in order to ensure costs are reported as consistently as possible.

The net cost calculation is intended to estimate the net system cost. Tip fees, collection service fees, contracting fees, franchise fees, and other funding mechanisms or charges related to collection and processing activities are <u>not</u> included in the net cost calculation as these are mechanisms for allocating the funding burden among waste generators, local governments, and service providers. While we realize that tip fees and other collection and processing revenues are sometimes included in the "net cost" calculations, in this analysis we are striving to capture net system costs for each management alternative, independent of particular funding mechanisms that may be used to allocate those costs. Costs may be allocated in many different ways and can be influenced by a variety of factors, e.g. politics, private versus public entity, government policies, etc. Revenues from the sale of recyclables (end-use material value), on the other hand, are included in the net cost analysis because they are needed to capture the entire cost and value inherent in the recycling value chain. These revenues, in effect, are a surrogate for the net cost

and value associated with recycling manufacturing, which is not otherwise analyzed in this study.

Avoided disposal costs are not included in the net cost of recycling calculation, but are identified as a cost savings and treated separately (see Calculation of Recycling Cost Savings). This is because of the complexity associated with calculating avoided disposal costs in practice. For example, diverting a percentage of waste from a particular garbage collection route may not allow a city to reduce the need to run the truck, staff it, etc.

Capital costs related to recycling are defined as:

Total Capital Costs = Capital Investment in New Processing Facilities + Capital Investment in New Collection Programs

For the purposes of the study, "new" collection programs and processing facilities refers to start-up of new facilities and programs required for increased diversion over and above diversion occurring in the base year of 2006.

All costs in the study will be estimated as a range, with the mid-point of the range used whenever a single data point is required.

Calculation of Recycling Cost Savings

The only potential cost savings associated with recycling that will be considered in this study is avoided disposal savings, resulting from potential savings (or cost) related to collection and disposal facilities as a result of recycling. This is defined as:

Net System Avoided Disposal Cost Savings of Recycling = Net Cost – Net Cost of Disposal

Any revenues recovered from the sale of end-use materials will be captured in the net cost calculation as defined earlier. As with calculating net operating costs, the project team's intent is to estimate any net system savings related to recycling as compared to disposal of materials, on a per-ton basis. Different players may experience different cost or revenue adjustments as materials are moved from the disposal stream to the recycling stream. Waste generators may see a cost increase or decrease, depending on the cost of recycling and disposal services offered to them locally. Recycling collectors may experience increased net revenue if they are winning new customers from disposal service providers. In calculating net cost savings, a significant consideration is the extent to which new recycling activities will require capital investments and/or the use of new trucks and collection systems.

Definition of Categories of Recyclable Materials to be Modeled

The material sub-categories to be modeled as recyclable in this project are listed in Table 1 below. For each of these materials, the project team will estimate net operating and capital costs and cost savings, and model users will be allowed to construct scenarios involving various recycling levels. Model users will not be able to construct recycling scenarios for those materials identified as non-recyclable in Table 1.

Table 1 – List of Recyclable and Non-Recyclable Material Sub-Categories

Waste Categories Included in Study	CIWMB Sub-Categories to Be Modeled as Recyclable (Equivalent WARM sub-category in parentheses)	CIWMB Sub-Categories Not Modeled as Recyclable	Notes on Non-Recyclable Sub-Categories
Paper	Uncoated corrugated cardboard and paper bags Newspaper Office paper Miscellaneous paper (mixed paper, general)	Remainder/composite Paper	No existing markets. Remainder/composite may be considered in alternative organics management strategies
Glass	Glass containers, all colors Flat glass (glass)	Remainder/composite glass	No existing markets
Metal	Tin/steel cans Other ferrous (steel cans) Aluminum cans Other non-ferrous (aluminum cans)	Major appliances Used oil filters Remainder/composite metals	No existing markets
Plastic	PET Containers HDPE Containers Miscellaneous Containers Plastic bags - trash, grocery, merchandise (LDPE) Non-bag commercial/industrial packaging film (LDPE)	Film products Other film Durable plastic items Remainder/composite plastic	No existing markets
Construction & Demolition	Concrete (aggregate) Asphalt paving (aggregate) Lumber	Asphalt roofing Gypsum board Rock, soil and fines Remainder/composite C&D	No existing markets and/or no LCA data available
Organics		All Categories	Considered under alternative organics management strategies
Household Hazardous Waste		All Categories	Not modeled due to small volume and/or lack of markets
Special Waste	Carpet	All Other Categories	Not included in study scope. No LCA data available for tires other than retreading.
Mixed Residue		All Categories	Considered under alternative organics management strategies
Alternative Daily Cover		All Categories	Considered under alternative organics management strategies

Definition of the categories of collection systems and processing facilities to be modeled
Analyzing collection systems and recycling facilities is complicated by a lack of widely accepted, standard definitions, and by the great diversity among facilities, especially those handling non-residential generated recyclables. Table 2 provides one list developed by the project team that is intended to broadly cover the majority of collection systems and recycling facilities that are currently in use in California.

The project team is recommending that both a residential curbside recycling collection system and a commercial recycling collection system be modeled. We anticipate using a range of cost values for these two types of collection scenarios that reasonably captures the variability in systems and costs in practice. Depending on data availability, the range of cost values will attempt to represent differences in commercial collection methods, such as self-haul or collection by private contractors and in residential collection methods such as automated vs manual or single stream vs. dual stream. We understand that, while these two scenarios can't possibly represent all the collection scenarios, we think that limiting the study to residential and commercial collection, and providing a range of cost values for these collection scenarios will result in an approach that satisfactorily addresses collection costs for most users of the model.

Table 2
UNVERISE OF KEY MSW COLLECTION SYSTEMS AND RECYCLING FACILITIES
(Check Marks Indicate Systems in Place in California)
July 29, 2008

		FACILITY TYPES											
		Large, Highly Automated MRF	Large, Labor Intensive MRF	Small, Labor Intensive MRF	Drop-Off Recycling Center	Redemp-tion Center	Mixed Waste MRF	Commercial Paper Processor	Scrap Metal Processor	C&D Processor	Other Processor (e.g., glass, Ewaste, etc.)	Disposal Facility Select Diversion/ Scavenging	WTE/Con-version Front End Processing
COLLECTION SYSTEM TYPES	**Residential Waste**												
	Mixed Waste - Automated Collection						X						X
	Mixed Waste - Manual Collection						X						X
	Curbside Recycling - Manual Collection	X	X	X									
	Curbside Recycling - Automated Collection	X	X										
	Multi-Bin, Source Separated Curbside Recycling	X	X	X									
	Self Haul				X	X					X	X	
	Commercial Waste												
	Commercial Pick Up (mixed waste or source separated materials)							X	X	X		X	X
	C&D/Commercial Self Haul				X					X	X	X	

The project team is recommending that three categories of recycling processing facilities be modeled: large, highly automated MRFs; small, highly labor-intensive MRFs and C&D MRFs. Reasons for this recommendation include:

- An assumption that the majority of increased recycling tonnages will pass through one of these facility types.
- An assumption that the other recycling facility types not explicitly modeled can be approximated by model users as one of the three modeled types.
- The large number of facility types would be impossible to model separately given the project resources and would not add value to the model results.

In addition, a fourth scenario will be modeled to reflect commercial material that is self-baled and self-hauled directly to material brokers.

Description of the Gathering Methodology for Recycling Cost Analysis

The project team intends to undertake a two-prong approach to gathering data for the recycling cost analysis: 1) primary research to gather data and input directly from California collection programs and facilities; and 2) secondary research to gather cost information from published sources.

For the primary research step, we will contact between three and seven programs and facilities in each region. For each contact, we will seek commitments to provide detailed cost breakdowns and complete the survey within the necessary time period. Because of concerns over confidentiality and time, and/or a lack of readily available detailed cost information, we envision we will only be able to obtain detailed cost data from a small number of facilities and programs. Primary research will include contacts with local government agencies to seek publicly available cost data on collection and processing facilities, assistance securing participation from local facility owners/managers, and general input on the study. Private entities will be contacted and offered the option of participating in the survey and entering into a confidentiality agreement to keep their responses secure.

Table 3 lists the local agencies and facilities we envision contacting, subject to time and resource constraints. Note that this scope is limited to California regions and the state and does not include consideration of transporting recyclables outside the state, (e.g to East Asia). However, we will investigate the extent to which transportation costs are reflected in the end-use material values and to the degree they are not, we will attempt to estimate these costs on an average basis. The project team feels this mix of local agencies and facilities will provide data and input from a representative range of facilities and program types.

Table 3 List of Local Agencies and Recycling Facilities to be Contacted

Region	Local Agencies	Recycling Facilities
Southern Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties)	Alameda County/Stopwaste.org San Jose Department of Environment City of Sunnyvale City/County of San Francisco South Bay Waste Management Authority	• Davis Street (Large MRF and separate C&D facility) • Newby Island (Large MRF and C&D facility) • Recycle Central at Pier 96 (very large, automated MRF) • California Waste Solutions (large, highly automated MRF) • South San Francisco Scavenger Company (new collection fleet and small, labor-intensive MRF) • SMART Station (large MRF) • Fremont Recycling and TS (Small, labor-intensive MRF and new C&D facility) • South Bayside Integrated Facility (Small, automated MRF) • ACI Recycling and TS (Small, automated MRF) • Berkeley Recycling (Small, labor-intensive MRF) • Brentwood SW TS • Central Processing Facility
Greater Los Angeles (Los Angeles, Orange, Riverside, and San Bernardino counties)	Los Angeles County Sanitation Districts City of Los Angeles Mojave Mountain and Desert JPA City of Long Beach Orange County IWMD County of Riverside County of San Bernardino	• City Fibers (Large MRF) • Smurfit-Stone, Los Angeles (Large MRF) • Sun Valley Paper Stock (Automated paper MRF) • Master Recycling Center (small-mid-sized MRF) • CVT Regional MRF (Combined MRF/Mixed Waste Processing) • Construction & Demolition Recycling (C&D) • DART Facility (Small, Labor-intensive MRF) • Puente Hills MRF • West Valley MRF (Large, automated MRF and C&D) • Southern California Recycling • Stanton Recycling/TS • Rainbow Transfer/Recycling Co. • Central LA Recycling/TS • Culver City TS/Recycling • Downtown Diversion

Region	Local Agencies	Recycling Facilities
Southern Central Valley (Fresno, Kern, Kings, Madera, and Tulare counties)	Fresno DPW, Recycling Division County of Fresno Kern County City of Modesto City of Visalia City of Bakersfield	• Rice Road Recyclery (Small MRF + C&D) • Victor Valley MRF (small-mid-size MRF) • USA Waste (MRF + C&D) • Cedar Ave Recycling/TS • Gilton Resource Recovery/TS • KWRA MRF (Small mixed waste) • Tulare County Recycling Complex • Kroeker, Inc. (Small labor-intensive C&D recycling) • Sunset Wastepaper MRF/TS • Central Valley Waste Services • Mt. Vernon Ave Recycling & Composting • Kern Valley Recycling/TS

In the secondary research stage we will gather data as they are available from previous studies. Wherever possible, data will be sought that are California-specific.

An important component of the recycling net cost analysis is the estimated range of material value to end-users. In addition to requesting typical material values from recycling facility managers, we will consult secondary sources such as the California Department of Conservation (for aluminum, glass and plastic containers); and American Metals Markets/Recycling Manager (for all metals), as well as trade associations such as American Forest and Paper Association and the Construction Materials Recycling Network. Additionally we will consult the list of recyclables pricing sources provided for many materials by U.S. EPA online at http://www.epa.gov/jtr/comm/pricing.htm.